

WHAT IS CLAIMED IS:

1. A method for cleaning a plasma etching apparatus comprising the steps of:
filling a chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas
5 wherein BO_x is adhered to an inside of the chamber as a residue; and
generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based
gas to remove the BO_x .
2. A method for cleaning a plasma etching apparatus according to claim 1,
10 wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
plasma etching apparatus.
- 15 3. A method for cleaning a plasma etching apparatus according to claim 1,
wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and
 NF_3 .
4. A method for cleaning a plasma etching apparatus according to claim 2,
20 wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and
 NF_3 .
5. A method for cleaning a plasma etching apparatus according to claim 1,
wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
25 gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed

gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

6. A method for cleaning a plasma etching apparatus according to claim 2,
wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
5 gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed
gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

7. A method for cleaning a plasma etching apparatus according to claim 3,
wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
10 gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed
gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

8. A method for cleaning a plasma etching apparatus comprising the steps of:
performing plasma etching using a gas containing BCl_3 as an etching gas in a
15 chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a
fluorine-based gas after the plasma etching; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based
gas.

20

9. A method for cleaning a plasma etching apparatus according to claim 8,
wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
25 plasma etching apparatus.

10. A method for cleaning a plasma etching apparatus according to claim 8, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

5

11. A method for cleaning a plasma etching apparatus according to claim 9, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

10

12. A method for cleaning a plasma etching apparatus according to claim 8, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

15

13. A method for cleaning a plasma etching apparatus according to claim 9, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

20

14. A method for cleaning a plasma etching apparatus according to claim 10, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

25

15. A method for cleaning a plasma etching apparatus comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in a chamber;

replacing the etching gas in the chamber with a mixed gas of Cl_2 and a fluorine-based gas or Cl_2 after the plasma etching; and

5 generating plasma from the mixed gas of Cl_2 and the fluorine-based gas or the Cl_2 before a plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas.

16. A method for cleaning a plasma etching apparatus according to claim 15,
10 wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

15 17. A method for cleaning a plasma etching apparatus according to claim 15, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

18. A method for cleaning a plasma etching apparatus according to claim 16,
20 wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

19. A method for cleaning a plasma etching apparatus according to claim 15,
 wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
25 gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed

gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

20. A method for cleaning a plasma etching apparatus according to claim 16,
wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
5 gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed
gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

21. A method for cleaning a plasma etching apparatus according to claim 17,
wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
10 gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed
gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

22. A method for cleaning a plasma etching apparatus comprising the steps of:
performing plasma etching using a gas containing BCl_3 as an etching gas in a
15 chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a
fluorine-based gas after the plasma etching; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based
gas before performing plasma etching using a gas containing SF_6 as an etching gas.
20

23. A method for cleaning a plasma etching apparatus according to claim 22,
wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
25 plasma etching apparatus.

24. A method for cleaning a plasma etching apparatus according to claim 22, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

5

25. A method for cleaning a plasma etching apparatus according to claim 23, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

10

26. A method for cleaning a plasma etching apparatus according to claim 22, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

15

27. A method for cleaning a plasma etching apparatus according to claim 23, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

20

28. A method for cleaning a plasma etching apparatus according to claim 24, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

25

29. A method for cleaning a plasma etching apparatus including a chamber,

said method comprising the steps of:

filling the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas;

and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based

5 gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber,

wherein BO_x is adhered to the surface of the quartz at least partly exposed to the inside of the chamber as a residue.

10

30. A method for cleaning a plasma etching apparatus according to claim 29, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the
15 plasma etching apparatus.

31. A method for cleaning a plasma etching apparatus according to claim 29, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

20

32. A method for cleaning a plasma etching apparatus according to claim 30, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

25

33. A method for cleaning a plasma etching apparatus according to claim 29,

wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

5 34. A method for cleaning a plasma etching apparatus according to claim 30, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

10 35. A method for cleaning a plasma etching apparatus according to claim 31, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

15 36. A method for cleaning a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber;

replacing the etching gas in the chamber with a mixed gas of Cl_2 and a
20 fluorine-based gas or Cl_2 after the plasma etching; and

generating plasma from the mixed gas of Cl_2 and the fluorine-based gas or the Cl_2 ,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

25

37. A method for cleaning a plasma etching apparatus according to claim 36,
wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
5 plasma etching apparatus.

38. A method for cleaning a plasma etching apparatus according to claim 36,
wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and
 NF_3 .

10

39. A method for cleaning a plasma etching apparatus according to claim 37,
wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and
 NF_3 .

15 40. A method for cleaning a plasma etching apparatus according to claim 36,
wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed
gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

20 41. A method for cleaning a plasma etching apparatus according to claim 37,
wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based
gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed
gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

25 42. A method for cleaning a plasma etching apparatus according to claim 38,

wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

5 43. A method for cleaning a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching; and

10 generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas before performing plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

44. A method for cleaning a plasma etching apparatus according to claim 43, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

45. A method for cleaning a plasma etching according to claim 43, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

25

46. A method for cleaning a plasma etching apparatus according to claim 44, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

5 47. A method for cleaning a plasma etching apparatus according to claim 43, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

10 48. A method for cleaning a plasma etching apparatus according to claim 44, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

15 49. A method for cleaning a plasma etching apparatus according to claim 45, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

20 50. A method for cleaning a plasma etching apparatus including a chamber, said method comprising the steps of:

 performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber;

 replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a
25 fluorine-based gas after the plasma etching; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas before performing plasma etching using a gas containing SF_6 as an etching gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

5

51. A method for cleaning a plasma etching apparatus according to claim 50, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

10

52. A method for cleaning a plasma etching apparatus according to claim 50, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

15

53. A method for cleaning a plasma etching apparatus according to claim 51, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

20

54. A method for cleaning a plasma etching apparatus according to claim 50, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

25

55. A method for cleaning a plasma etching apparatus according to claim 51,

wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

5 56. A method for cleaning a plasma etching apparatus according to claim 52, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

10 57. A method for plasma etching comprising the steps of:
performing plasma etching a conductive film using a gas containing BCl_3 gas as an etching gas in a chamber;
replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching; and
15 generating a plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas before performing plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas.

20 58. A method for plasma etching according to claim 57, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

25 59. A method for plasma etching according to claim 57, wherein the

fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

60. A method for plasma etching according to claim 58, wherein the fluorine-based gas is selected from the group consisting of CF₄, SF₆ and NF₃.

5

61. A method for plasma etching according to claim 57, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

10

62. A method for plasma etching according to claim 58, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

15

63. A method for plasma etching according to claim 59, wherein the etching gas is replaced with Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas each of which is added with O₂, and plasma is generated from the Cl₂ or the mixed gas of Cl₂ and the fluorine-based gas each of which is added with O₂.

20

64. A method for plasma etching comprising the steps of:

performing plasma etching using a gas containing BCl₃ gas as an etching gas in a chamber;

replacing the etching gas in the chamber with Cl₂ or a mixed gas of Cl₂ and a

25 fluorine-based gas after the plasma etching;

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas; and

performing plasma etching using a gas containing SF_6 gas as an etching gas.

5 65. A method for plasma etching according to claim 64, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

10

66. A method for plasma etching according to claim 64, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

67. A method for plasma etching according to claim 65, wherein the
15 fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

68. A method for plasma etching according to claim 64, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the
20 fluorine-based gas each of which is added with O_2 .

69. A method for plasma etching according to claim 65, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the
25 fluorine-based gas each of which is added with O_2 .

70. A cleaning method for plasma etching apparatus according to claim 66, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed
5 gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

71. A method for plasma etching using a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in
10 the chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching;

generating plasma from Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas; and

15 performing plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

20 72. A method for plasma etching according to claim 71, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

25

73. A method for plasma etching according to claim 71, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

74. A method for plasma etching according to claim 72, wherein the
5 fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

75. A method for plasma etching according to claim 71, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the
10 fluorine-based gas each of which is added with O_2 .

76. A method for plasma etching according to claim 72, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the
15 fluorine-based gas each of which is added with O_2 .

77. A method for plasma etching according to claim 74, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the
20 fluorine-based gas each of which is added with O_2 .

78. A method for plasma etching using a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in
25 the chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching;

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas; and

5 performing plasma etching using a gas containing SF_6 gas as etching gas,
wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

79. A method for plasma etching according to claim 78, wherein a method
10 selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

15 80. A method for plasma etching according to claim 78, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

81. A method for plasma etching according to claim 79, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

20

82. A method for plasma etching according to claim 78, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

25

83. A method for plasma etching according to claim 79, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

5

84. A method for plasma etching according to claim 80, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 .

10

85. A method for manufacturing a semiconductor device comprising the steps of:

laminating a first conductive film and a second conductive film in sequence over an island shape semiconductor film with a gate insulating film interposed therebetween;

15

etching the first conductive film and the second conductive film to form a first shape of the first conductive film and a first shape of the second conductive film, respectively, by using a first etching gas;

replacing the first etching gas in a chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas wherein BO_x is adhered to an inside of the chamber as a residue; and

20

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas to remove the BO_x ; and

anisotropic etching the first shape of the first conductive film and the first shape of the second conductive film to form a second shape of the first conductive film

25

and a second shape of the second conductive film, respectively.

86. A method for manufacturing a semiconductor device according to claim
85, wherein a width of the second shape of the first conductive film is longer than that
5 of the second shape of the second conductive film in a channel length direction.

87. A method for manufacturing a semiconductor device according to claim
85, wherein a method selected from the group consisting of an RIE etching method, an
ICP etching method, an ECR etching method, a helicon wave etching method, a helical
10 resonance etching method and a pulse modulation etching method is adopted in the
plasma etching apparatus.

88. A method for manufacturing a semiconductor device according to claim
86, wherein a method selected from the group consisting of an RIE etching method, an
15 ICP etching method, an ECR etching method, a helicon wave etching method, a helical
resonance etching method and a pulse modulation etching method is adopted in the
plasma etching apparatus.

89. A method for manufacturing a semiconductor device according to claim
20 85, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6
and NF_3 .

90. A method for manufacturing a semiconductor device according to claim
86, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6
25 and NF_3 .

91. A method for manufacturing a semiconductor device according to claim 87, wherein the fluorine-based gas is selected from the group consisting of CF_4 , SF_6 and NF_3 .

5

92. A method for manufacturing a semiconductor device according to claim 85, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas, or Cl_2 gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added
10 with O_2 to remove the BO_x .

93. A method for manufacturing a semiconductor device according to claim 86, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2 , and plasma is generated from the
15 Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 to remove the BO_x .

94. A method for manufacturing a semiconductor device according to claim 87, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a
20 fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 to remove the BO_x .

95. A method for manufacturing a semiconductor device according to claim
25 89, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a

fluorine-based gas each of which is added with O_2 , and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 to remove the BO_x .